JC07 Rec'd PCT/PTO 04 MAY 2001

FORM PTO-1390 (Modified) (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	
L9289.01133	
U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/JP00/06240	September 13, 2000	September 17, 1999

TITLE OF INVENTION

RADIO TRANSMISSION/RECEPTION APPARATUS AND RADIO COMMUNICATION METHOD

APPLICANT(S) FOR DO/EO/US

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OIPE JC13 MAY 04 2001 PATENT & TRADEMARK OFFICE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include itens (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

PCT/IB/308
PCT/RO/101
Claim for Priority with PCT/IB/304

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/831057	PCT/JP00/06240	L9289.01133

24. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS PTO USE ONLY
☐	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	$1000.00
☒	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	$860.00
☐	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	$710.00
☐	International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)	$690.00
☐	International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)	$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =	**$860.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	11 - 20 =	0	x $18.00	**$0.00**	
Independent claims	4 - 3 =	1	x $80.00	**$80.00**	
Multiple Dependent Claims **(check if applicable).**			☐	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$940.00**	
Applicant claims small entity status. (See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				**$0.00**	
SUBTOTAL =				**$940.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				**$0.00**	
TOTAL NATIONAL FEE =				**$940.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).** ☒				**$40.00**	
TOTAL FEES ENCLOSED =				**$980.00**	
				Amount to be: refunded	$
				charged	$

a. ☒ A check in the amount of **$980.00** to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **19-4375** A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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NAME

28,732
REGISTRATION NUMBER

May 4, 2001
DATE

DESCRIPTION

RADIO TRANSMISSION/RECEPTION APPARATUS AND RADIO COMMUNICATION METHOD

Technical Field

The present invention relates to a radio transmission/reception apparatus and radio communication method in a TDMA- or FDMA-based radio communication system.

Background Art

In a radio communication system such as a cellular telephone and automobile telephone whose demand is increasing drastically in recent years, a base station installed for each cell assigns radio channels to a plurality of communication terminals that exist within the cell and performs radio communications simultaneously.

There are three main types of system to divide a plurality of radio channels, a TDMA (Time Division Multiple Access) system, FDMA (Frequency Division Multiple Access) system and CDMA (Code Division Multiple Access) system.

A radio communication system using a TDMA system or FDMA system (hereinafter referred to as "TDMA/FDMA system") of these types sends data with a pilot signal to be used for channel estimations and coherent detection,

etc. inserted into every slot.

FIG.1 illustrates a slot configuration of a conventional TDMA/FDMA system. As shown in FIG.1, the conventional TDMA/FDMA system inserts a pilot signal 12 before data signal 11 that carries information.

Then, in order to prevent data signals of the nearest slots from overlapping with each other due to a propagation delay, etc. on a receiving side, a guard signal 13 is inserted before the pilot signal 12 and a ramp signal 14 is inserted after the data signal 11.

Here, overhead sections of the guard signal 13, pilot signal 12 and ramp signal 14 except data signal 11 of the signal shown in the slot configuration diagram in FIG.1 are the parts that carry no information and it is desirable to have the shortest possible overhead sections to increase a data rate.

However, the conventional TDMA/FDMA system above needs to send data with the pilot signal 12 inserted for each slot, which reduces the percentage of data signal 11 in one slot resulting in a problem of reducing the data rate.

Disclosure of Invention

It is an object of the present invention to provide a radio transmission/reception apparatus and radio communication method in a TDMA/FDMA system capable of carrying out radio communications at a high data rate.

This object is attained by superimposing a spread

pilot signal on transmission data and thereby increasing the percentage of the transmission data in one slot in the TDMA/FDMA system.

Brief Description of Drawings

FIG.1 illustrates a slot configuration of a conventional TDMA/FDMA system;

FIG.2 is a block diagram showing a configuration of a radio transmission apparatus according to Embodiment 1 of the present invention;

FIG.3 is a block diagram showing a configuration of a radio reception apparatus according to the embodiment above;

FIG.4A illustrates a signal level before despreading according to the embodiment above;

FIG.4B illustrates a signal level after despreading according to the embodiment above;

FIG.5 illustrates a slot configuration of a superimposed signal according to the embodiment above;

FIG.6 is a block diagram showing a configuration of a radio reception apparatus according to Embodiment 2 of the present invention;

FIG.7 is a block diagram showing a configuration of a radio reception apparatus according to Embodiment 3 of the present invention; and

FIG.8 is a block diagram showing a configuration of a radio reception apparatus according to Embodiment 4 of the present invention.

Best Mode for Carrying out the Invention

With reference now to the attached drawings, embodiments of the present invention will be explained below.

(Embodiment 1)

FIG.2 is a block diagram showing a configuration of a radio transmission apparatus according to Embodiment 1 of the present invention.

In the radio transmission apparatus in FIG.2, coding section 101 performs coding processing such as error correction coding on transmission data and inserts a guard signal and ramp signal. Modulation section 102 performs modulation such as QPSK on the output signal of coding section 101.

Coding section 103 performs coding processing such as error correction coding on a pilot signal. Modulation section 104 performs primary modulation such as QPSK on the output signal of coding section 103. Spreading section 105 performs secondary modulation on the output signal of modulation section 104 by multiplying the signal by a specific spreading code.

The pilot signal is spread over the entire system band or over a wide band resulting from dividing the entire system band into several portions. Hereinafter, the spread pilot signal will be referred to as a "spread pilot signal". Superimposing section 106 superimposes the spread pilot signal output from modulation section

105 on the output signal of spreading section 102. Hereinafter, the signal resulting from superimposing the spread pilot signal on the transmission data will be referred to as a "superimposed signal".

Radio section 107 applies radio processing such as amplification and frequency conversion to the superimposed signal and then transmits the signal from transmission antenna 108 by time division or frequency division.

By the way, in the explanation above, the pilot signal is totally spread and superimposed, but it is also possible not to spread some part of the pilot signal and insert that part into the transmission data and spread and superimpose the rest of the pilot signal. This is effective when a pilot signal is assigned two or more functions such as channel estimation and coherent detection.

Here, the present invention is also applicable to a case where the radio transmission apparatus has a plurality of transmission systems and transmits signals of a plurality of channels. However, in this case, simply increasing the above components according to the transmission channels will require transmission antennas corresponding in number with the transmission channels though the number of the transmission antennas is preferred to be small.

Therefore, when signals of a plurality of channels are sent, the signals are multiplexed and the multiplexed

signal is sent from one transmission antenna. This makes it possible to increase a data rate and reduce the number of transmission antennas compared to the number of transmission channels.

FIG.3 is a block diagram showing a configuration of the radio reception apparatus according to Embodiment 1 of the present invention.

Radio section 202 applies radio processing such as amplification and frequency conversion to the signal received by reception antenna 201.

Demodulation section 203 demodulates the output signal of radio section 202. Decoding section 204 performs decoding processing such as error correction on the output signal of demodulation section 203 and extracts reception data.

By the way, the effect of the spread pilot signal acting as an interference component on the transmission data is small. This is because since the spread pilot signal can use a processing gain as shown in FIG.4A, it is possible to reduce the level of the spreading pilot signal to a level smaller than that of the transmission data.

Despreading section 205 multiplies the output signal of radio section 202 by a same code as the spreading code multiplied by spreading section 105. Demodulation section 206 demodulates the output signal of despreading section 205. Decoding section 207 performs decoding processing such as error correction on the output signal

of demodulation section 206. This makes it possible to extract the pilot signal spread and superimposed on a transmitting side.

By the way, the effect of the transmission data multiplied by a spreading code by despreading section 205 acting as an interference component on the pilot signal is small. This is because the pilot signal can obtain the gain before the spreading through the despreading processing as shown in FIG.4B, while the level of the transmission data is reduced by being multiplied by the spreading code.

Then, a signal flow between the radio transmission apparatus shown in FIG.2 and the radio reception apparatus shown in FIG.3 will be explained.

The transmission data is coded by coding section 101, modulated by modulation section 102 and sent to superimposing section 106. On the other hand, the pilot signal is coded by coding section 103, modulated by modulation section 104, spread by spreading section 105 and sent to superimposing section 106.

The spread pilot signal is superimposed on the transmission data by superimposing section 106. The output signal of superimposing section 106 is subjected to predetermined radio processing by radio section 107 and then sent from transmission antenna 108.

The signal transmitted from transmission antenna 108 is received by reception antenna 201 and subjected to predetermined radio processing by radio section 202.

The output signal of radio section 202 is demodulated by demodulation section 203, decoded by decoding section 204 and reception data is extracted.

On the other hand, the output signal of radio section 202 is despread by despreading section 205, demodulated by demodulation section 206, decoded by decoding section 207 and the pilot signal is extracted.

Then, a slot configuration of the superimposed signal according to this embodiment will be explained using FIG.5.

As shown in FIG.5, in the superimposed signal according to this embodiment, guard signal 302 is inserted before data signal 301, ramp signal 303 is inserted after data signal 301 and spread pilot signal 304 is superimposed over the entire slot.

In this way, sending transmission data with a pilot signal spread and superimposed on the transmission data eliminates the necessity of symbols, which are required for each conventional slot to transmit pilot signals and thereby makes it possible to increase the percentage of the data signal in one slot and increase the data rate.

(Embodiment 2)

FIG.6 is a block diagram showing a configuration of a radio reception apparatus according to Embodiment 2 of the present invention. The components in FIG.6 common to those in FIG.3 are assigned the same reference numerals as those in FIG.3 and explanations thereof are omitted.

When compared to FIG.3, the radio reception apparatus shown in FIG.6 adopts a configuration with channel estimation section 401 added. Channel estimation section 401 performs a channel estimation using a pilot signal decoded by decoding section 207 and outputs channel estimation data.

While the conventional TDMA/FDMA system can only incorporate a pilot signal for each slot and can therefore perform channel estimations only intermittently, this embodiment can successively perform channel estimations using pilot signals transmitted at any time.

As a result, this embodiment can increase the frequency of updating a tap coefficient of an equalizer, etc. and improve the characteristic. Performing channel estimations is effective especially for a long slot with a slot length of 10 ms. In this case, the pilot signal must be spread over a band wide enough to correctly perform a channel estimation of the data signal within a narrow band.

(Embodiment 3)

FIG.7 is a block diagram showing a configuration of a radio reception apparatus according to Embodiment 3 of the present invention. The components in FIG.7 common to those in FIG.3 are assigned the same reference numerals as those in FIG.3 and explanations thereof are omitted.

When compared to FIG.3, the radio reception

apparatus shown in FIG.7 adopts a configuration with distance estimation section 501 added. Distance estimation section 501 performs a distance estimation using a pilot signal decoded by decoding section 207 and outputs distance estimation data.

This makes it possible to estimate the distance from the propagation time from the transmission to reception using the received pilot signal. Since the pilot signal is spread and sent over a wide band, it is possible to calculate the propagation time from the transmission to reception with fine time resolution and thereby improve distance estimation accuracy.

By the way, this embodiment can also be combined with Embodiment 2.

(Embodiment 4)

As explained above, the reception quality in Embodiment 1 may slightly deteriorate compared to the conventional art due to influences of the spread pilot signal. To solve this problem, Embodiment 4 is intended to improve the reception quality by stripping the reception signal of the spread pilot signal.

FIG.8 is a block diagram showing a configuration of a radio reception apparatus according to Embodiment 4 of the present invention. The components in FIG.8 common to those in FIG.3 are assigned the same reference numerals as those in FIG.3 and explanations thereof are omitted.

In the radio reception apparatus in FIG.8,

modulation section 601 performs the same modulation processing as that in modulation section 104 on the output signal of demodulation section 206. Spreading section 602 performs the same spreading processing as that in spreading section 105 on the output signal of modulation section 601 and outputs a spread pilot signal.

Elimination section 603 inputs the spread pilot signal from spreading section 602, subtracts the spread pilot signal from the output signal of radio section 202 and thereby eliminates the spread pilot signal included in the output signal of radio section 202.

The signal output from elimination section 603 passes through a BPF (Band Pass Filter) and is demodulated in demodulation section 203, decoded by decoding section 204 and reception data is extracted.

Thus, it is possible to improve the reception quality by eliminating the spread pilot signal, which becomes interference with the data signal.

By the way, this embodiment can be combined with Embodiment 2 and Embodiment 3.

As is clear from the above explanations, the radio transmission/reception apparatus and radio communication method of the present invention can send data with a pilot signal spread and superimposed on transmission data and eliminate the necessity of a symbol which is required by a conventional TDMA/FDMA system for each slot to transmit a pilot signal, and can thereby increase the percentage of the data signal in one slot

and increase the data rate.

Furthermore, by using a pilot signal extracted by despreading the reception signal, it is possible to successively perform channel estimations and improve distance estimation accuracy by calculating the propagation time from the transmission to reception with fine time resolution.

This application is based on the Japanese Patent Application No.HEI 11-263600 filed on September 17, 1999, entire content of which is expressly incorporated by reference herein.

Industrial Applicability

The present invention is ideally applicable to a radio communication base station apparatus or radio communication terminal apparatus in a TDMA-based or FDMA-based radio communication system.

What is claimed is:

1. A radio transmission apparatus comprising:

first spreading means for spreading a pilot signal;

superimposing means for superimposing the spread pilot signal on transmission data; and

transmitting means for transmitting the output signal of this superimposing means by time division or frequency division.

2. The radio transmission apparatus according to claim 1, wherein the transmitting means transmits a signal resulting from multiplexing signals of a plurality of channels from one transmission antenna.

3. A radio reception apparatus comprising:

receiving means for receiving a signal transmitted from the radio transmission apparatus according to claim 1; and

despreading means for extracting a pilot signal by despreading the output signal of this receiving means.

4. The radio reception apparatus according to claim 3, further comprising channel estimating means for performing a channel estimation using the pilot signal.

5. The radio reception apparatus according to claim 3, further comprising distance estimating means for performing a distance estimation using the pilot signal.

6. The radio reception apparatus according to claim 3, further comprising:

second spreading means for spreading the pilot signal output from the despreading means; and

eliminating means for subtracting the output pilot signal of said second spreading means from the output signal of the receiving means.

7. A radio communication terminal apparatus equipped with a radio transmission apparatus, said radio transmission apparatus comprising:

first spreading means for spreading a pilot signal;

superimposing means for superimposing the spread pilot signal on transmission data; and

transmitting means for transmitting the output signal of this superimposing means by time division or frequency division.

8. A radio communication terminal apparatus equipped with a radio reception apparatus, said radio reception apparatus comprising:

receiving means for receiving a signal transmitted from the radio transmission apparatus according to claim 1; and

despreading means for extracting a pilot signal by despreading the output signal of this receiving means.

9. A radio communication base station apparatus equipped with a radio transmission apparatus, said radio transmission apparatus comprising:

first spreading means for spreading a pilot signal;

superimposing means for superimposing the spread pilot signal on transmission data; and

transmitting means for transmitting the output signal of this superimposing means by time division or

frequency division.

10. A radio communication base station apparatus equipped with a radio reception apparatus, said radio reception apparatus comprising:

receiving means for receiving a signal transmitted from the radio transmission apparatus according to claim 1; and

despreading means for extracting a pilot signal by despreading the output signal of this receiving means.

11. A radio communication method comprising steps of:

spreading a pilot signal, superimposing the spread pilot signal on transmission data and transmitting the superimposed signal by time division or frequency division on a transmitting side; and

despreading the reception signal and extracting the pilot signal on a receiving side.

ABSTRACT

Coding section 101 performs coding processing on transmission data and modulation section 102 modulates the output signal of coding section 101. Coding section 103 performs coding processing on a pilot signal, modulation section 104 performs primary modulation on the output signal of coding section 103 and spreading section 105 performs secondary modulation on the output signal of modulation section 104 by multiplying the signal by a specific spreading code. Superimposing section 106 superimposes the output signal of modulation section 102 and the spread pilot signal output from spreading section 105. Radio section 107 applies predetermined radio processing to the superimposed signal and then transmits the signal from transmission antenna 108 by time division or frequency division. This allows a radio communication system that adopts a TDMA system or FDMA system to perform radio communications at a high data rate.

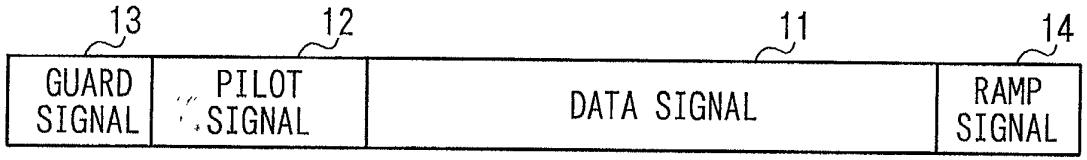
13
12
11
14
GUARD SIGNAL
PILOT SIGNAL
DATA SIGNAL
RAMP SIGNAL

FIG. 1

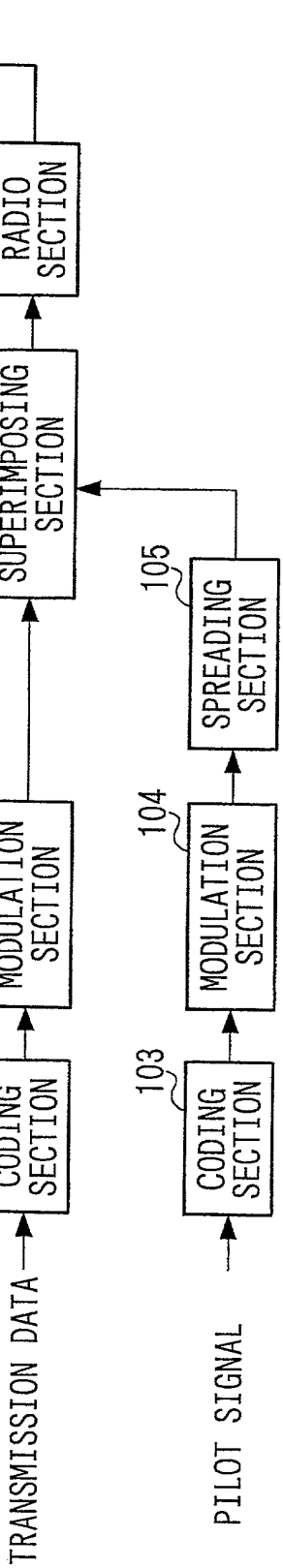
TRANSMISSION DATA
PILOT SIGNAL
101
CODING SECTION
102
MODULATION SECTION
103
CODING SECTION
104
MODULATION SECTION
105
SPREADING SECTION
106
SUPERIMPOSING SECTION
107
RADIO SECTION
108

FIG. 2

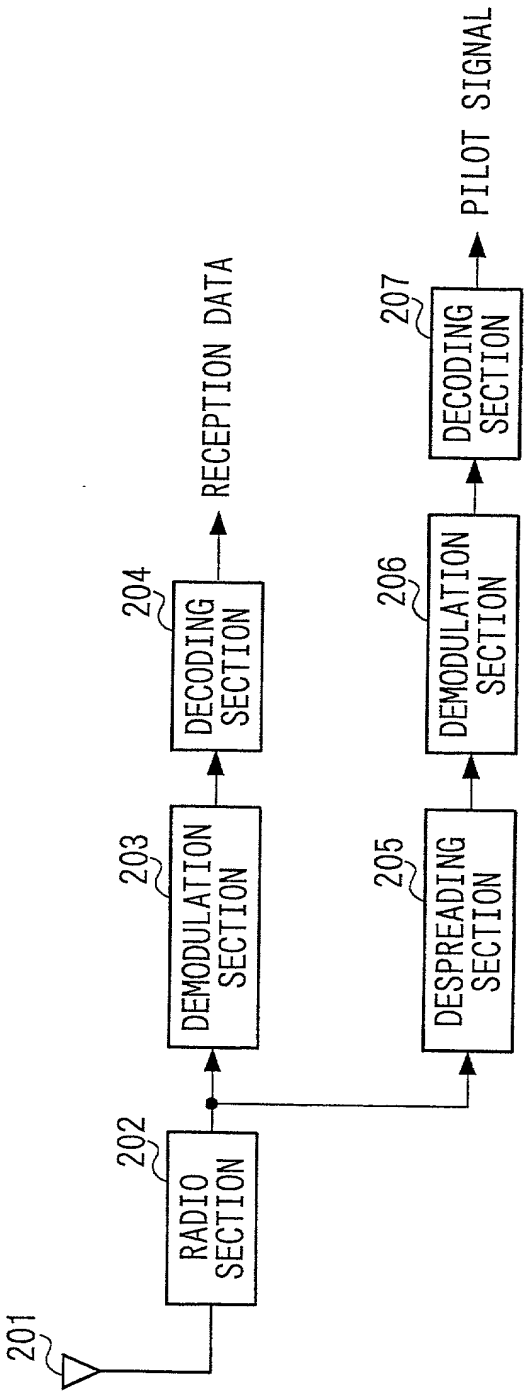
201
RADIO SECTION
202
DEMODULATION SECTION
203
DECODING SECTION
204
RECEPTION DATA
DESPREADING SECTION
205
DEMODULATION SECTION
206
DECODING SECTION
207
PILOT SIGNAL

FIG. 3

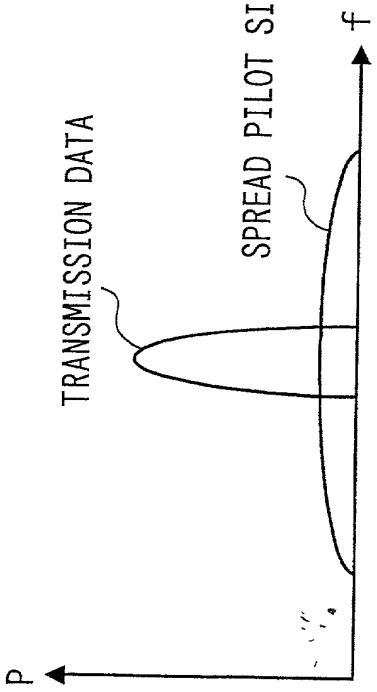
TRANSMISSION DATA
SPREAD PILOT SIGNAL
f
P

FIG. 4A

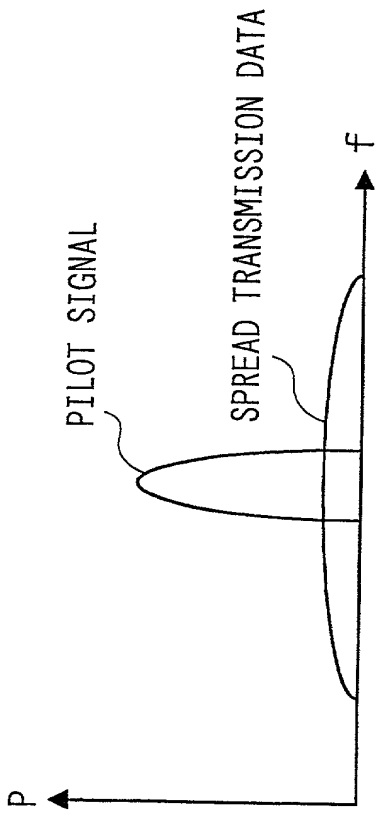
PILOT SIGNAL
SPREAD TRANSMISSION DATA
f
P

FIG. 4B

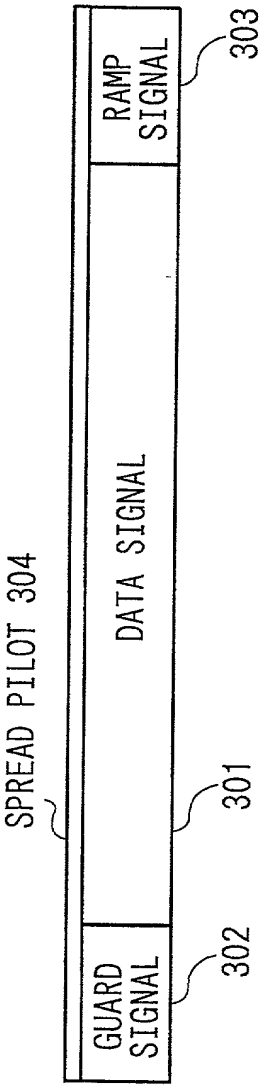
SPREAD PILOT 304
GUARD SIGNAL
302
DATA SIGNAL
301
RAMP SIGNAL
303

FIG. 5

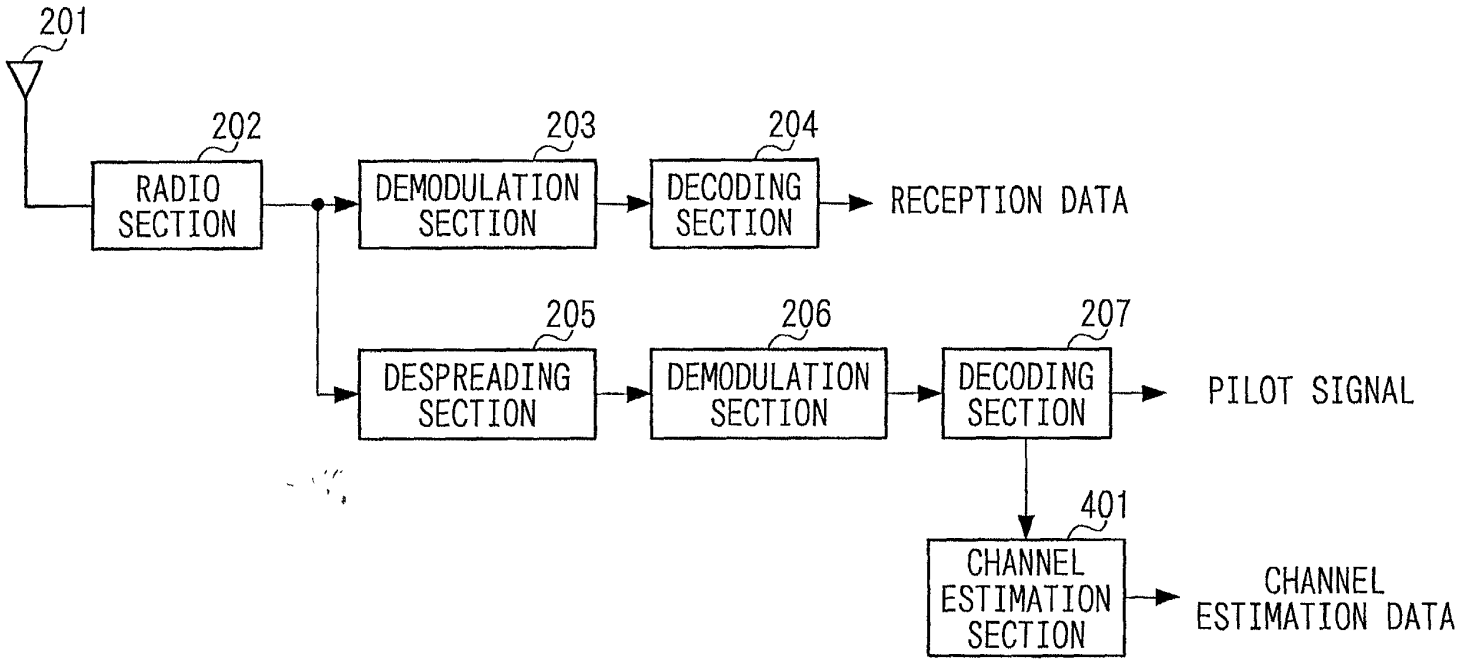

FIG. 6

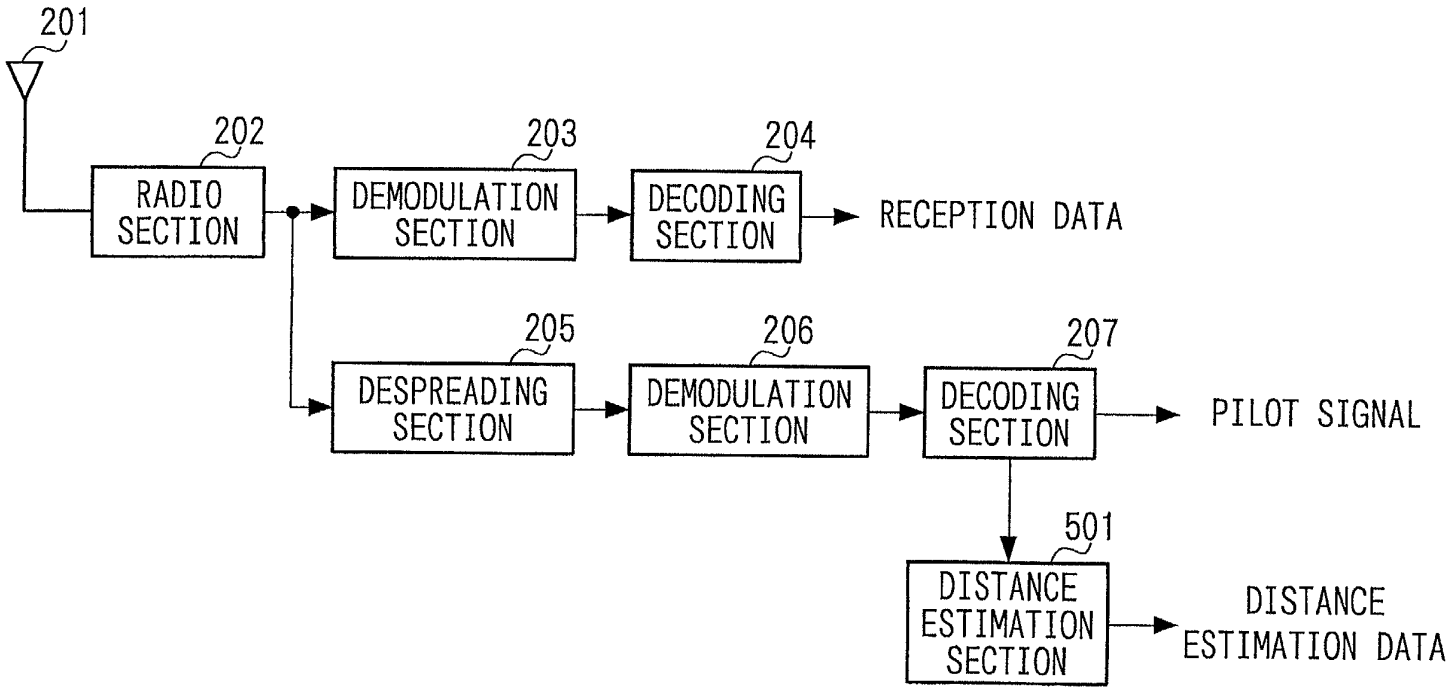

FIG. 7

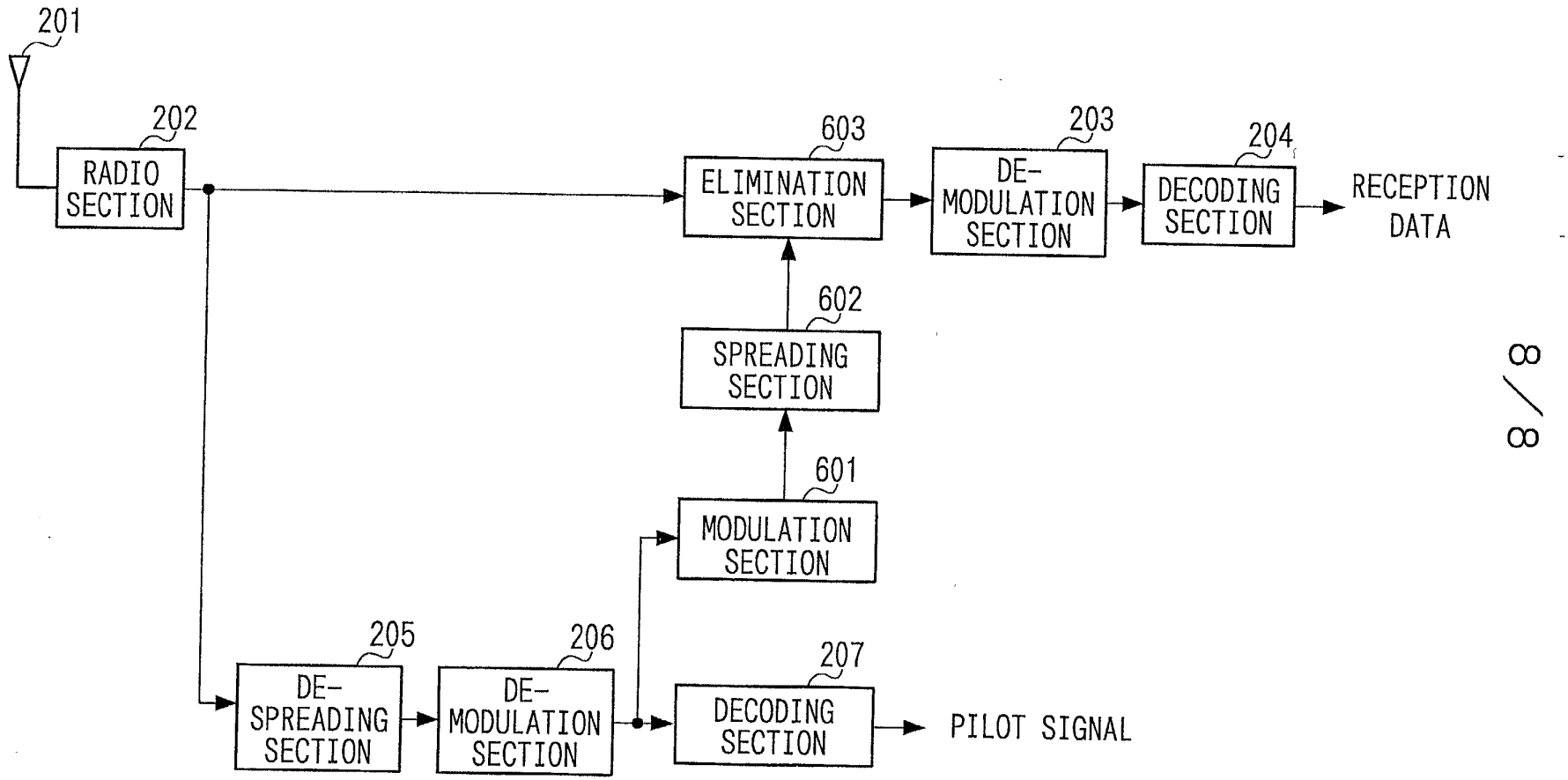

FIG. 8

APPLICATION FOR UNITED STATES PATENT
Declaration for Patent Application

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on

the invention entitled: RADIO TRANSMISSION/RECEPTION APPARATUS AND RADIO COMMUNICATION METHOD

the specification of which 2 (file no _____)

(check at least one)
3 [x] is attached hereto
4 [ ] was filed on _____ as (5) U.S. Application Serial No. _____
6 [ ] and was amended _____ (if applicable)

Use this portion only if you are entering the U.S. National phase based on a PCT International Application designating the U.S.

7 [x] was filed as PCT international application
8 Number ~~PCT/JP00/06240~~
9 on ~~September 13, 2000~~
and was amended under PCT Article(s) 19 and/or 34
10 on _____ (if applicable).
11 priority date claimed in PCT International Application

(Country)	(Number)	(Day/Month/Year Filed)
JAPAN	JP11-263600	17/September/1999

I hereby declare that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended, by any amendment referred to above.
I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me which is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.
I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application (s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date earlier than that of the application(s) on which priority is claimed.

Prior (Foreign) Application(s) any Priority Claims Under 35 U.S.C. 119

12a	(Country)	(Number)	(Day/Month/Year Filed)	Priority Claimed [ ] Yes	[ ] No
	(Country)	(Number)	(Day/Month/Year Filed)	[ ] Yes	[ ] No

Priority Claim(s) from U.S. Provisional Application(s) – I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

12b	Application No.	Day/Month/Year Filed	Application No.	Day/Month/Year Filed

Do not use this portion to identify a PCT application if the parent application is the U.S. National phase of the PCT application

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between filing date of the prior application and the national or PCT international filing date of this application.

13	(U.S. Application Number)	(U.S. Filing Date)	Status (patented, pending, abandoned)

I hereby appoint the following attorneys of the firm of Stevens, Davis, Miller & Mosher, L.L.P. as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent and Trademark Office:

3 James E. Ledbetter, Reg. No. 28732; Thomas P. Pavelko, Reg. No. 31689; and Anthony P. Venturino, Reg. No. 31674.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO STEVENS, DAVIS, MILLER & MOSHER, L.L.P., 1615 L Street, N.W., Suite 850, Washington, D.C. 20036, TELEPHONE (202) 408-5100, FACSIMILE (202) 408-5200.

See page 2 for signature lines

other side for instructions for completing this form

STEVENS, DAVIS, MILLER & MOSHER, L.L.P.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application or any patent issuing thereon.

PAGE 2 OF U.S.A. DECLARATION FORM

14a	Typewritten Full Name of Sole or First Inventor 1-00	**Junichi** (Given Name)		**AIZAWA** (Family Name)	
15a	Inventor's Signature	Junichi		Aizawa	
16a	Date of Signature	February (Month)	23, (Day)	2001 (Year)	
17a	Residence	**Yokohama-shi** JPX (City)	**Kanagawa** (State or Province)	**JAPAN** (Country)	
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14b	Typewritten Full Name of Sole or First Inventor 2-00	**Osamu** (Given Name)		**KATO** (Family Name)	
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14c	Typewritten Full Name of Sole or First Inventor 3-00	**Mitsuru** (Given Name)		**UESUGI** (Family Name)	
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14d	Typewritten Full Name of Sole or First Inventor 4-00	**Takeshi** (Given Name)		**AKIYAMA** (Family Name)	
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16d	Date of Signature	February (Month)	23, (Day)	2001 (Year)	
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*Note to Inventor: Please sign name on line 15 exactly as it appears in line 14 and insert the actual date of signing on line 16. If there are more than four inventors, please add a copy of this page for identification and signatures for the additional inventors.